Quantity Discounts/ Economic Order Quantity

New Quantity Discount Analysis Tool Lets DoD Buyers Save on Total Cost and Receive More Goods

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We don't always buy the lowest total cost quantity when we buy a quantity-discounted item. We often spend more than we should. This article will show how to buy the lowest total cost quantity, save the buyer money and, in some cases, receive more goods.

Contractors offer quantity discounts. When we buy more of an item, we pay a lower unit cost. However, we should be interested in the *total* purchase cost (quantity x unit cost). With quantity discounts, the lowest total cost quantity can frequently be a larger quantity than typically bought. Let us clarify with an example.

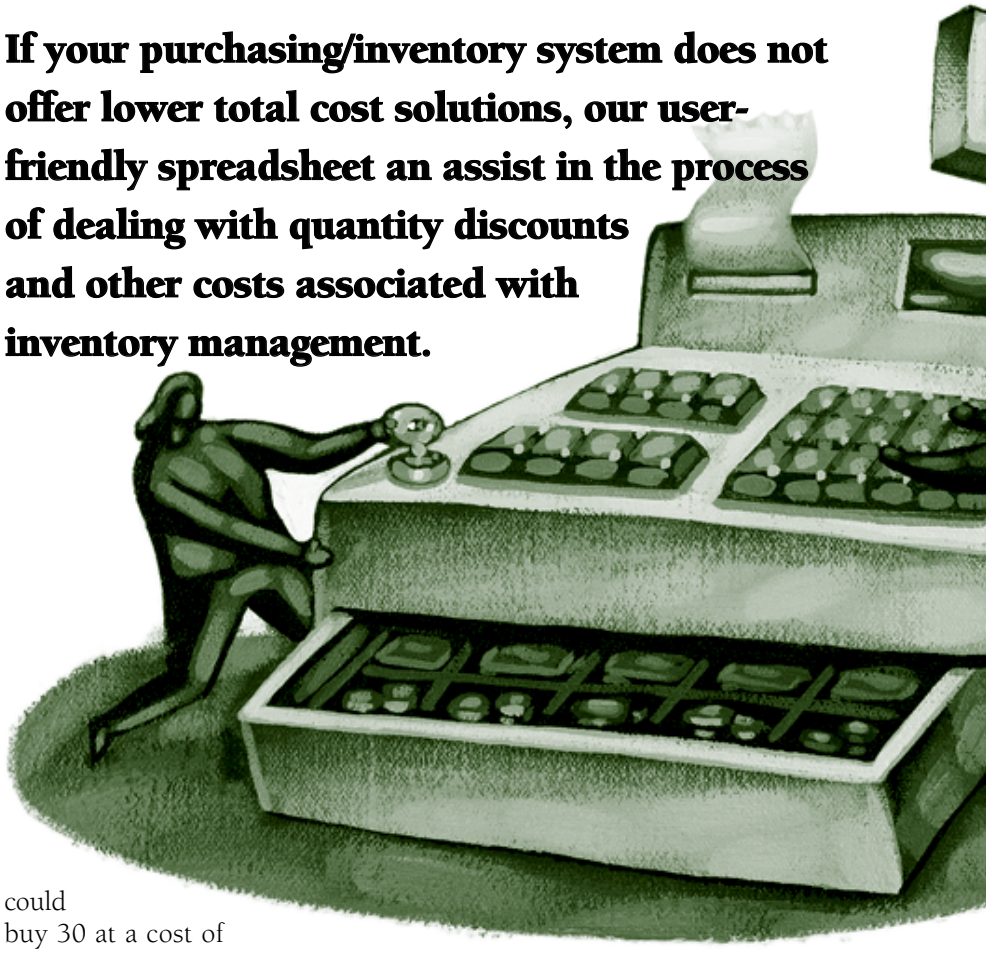
An electronics supplier offered an item at the following range quantities and unit prices:

Quantities	Unit Prices
1-29	$24,484 each
30-59	$7,059 each
60 and up	$6,553 each

How much would you pay for 10 of these items?

For a one-time buy of 10, the total cost would be 10 x $24,484 or $244,840. However, there is a better solution. If we bought 30, we would pay 30 x $7,059 or $211,770. We save $33,070 and obtain 20 more. Let's say we needed 17. Although 17 cost $416,228, we could buy 30 at a cost of $211,770 or 60 at a cost of $393,180.

If your purchasing/inventory system does not offer lower total cost solutions, our user-friendly spreadsheet an assist in the process of dealing with quantity discounts and other costs associated with inventory management.



If we needed to purchase 10 every month, we could buy 10 monthly at a yearly cost of $2,938,080. But by buying 30 units four times a year the cost would be $847,080, and two groups of 60 would cost $786,360. We would offer that many of us would not take the added step to calculate these alternative lower cost solutions.

If your purchasing/inventory system does not offer these lower total cost solutions, our user-friendly spreadsheet can assist in the process of dealing with quantity discounts and the other costs associated with inventory management.

This article will cover nuances about quantity discounts and provide a short explanation about Economic Order

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Quantities, or EOQs. The Quantity Discount EOQ Analysis Tool (spreadsheet) and associated documentation are absolutely free. Points of contact are provided at the end of this article.

Quantity Discounts

Figure 1 depicts what occurs with quantity discounts using the preceding "Unit Cost versus Quantity" example. The graph displayed in Figure 1 steps down as the quantities increase. This is expected.

Figure 2 shows the "Total Cost versus Quantity." As each new range appears, a drop in total cost results. If we drew horizontal lines across Figure 2 from the first quantity of the latter two ranges to the early ranges and then dropped the vertical lines, the results would look like Figure 3.

For a one-time purchase, Figure 3 shows that instead of buying quantities 9-29 and 55-59, buying 30 and/or 60 is cheaper. These are the simple cases involving one-time buys.

For recurring buys, we want to buy at the lowest total cost based on our demand rate, quantity ranges, the unit costs, ordering and holding costs, the shelf life of the item, and remaining useful life of the item. The Quantity Discount EOQ Analysis Tool we have developed contains these options for recurring buys.

FIGURE 1. **Unit Cost vs. Quantity**

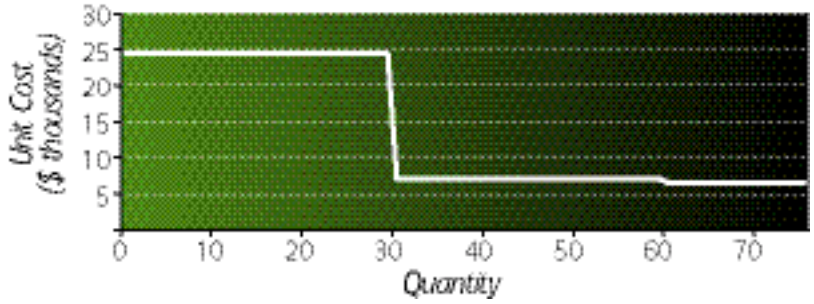
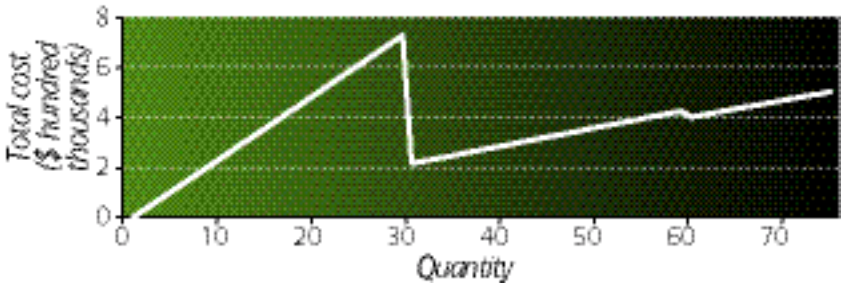


FIGURE 2. **Total Cost vs. Quantity**



Economic Order Quantities

Understanding the EOQ is essential to fully understanding quantity discounts and inventory theory. For an item with one unit price and a known recurring demand rate, there exists an EOQ that should be purchased to minimize the life cycle costs of purchasing and holding this item.

In Figure 4 (next page), as the quantity purchased increases, the unit cost remains constant, the procurement costs decrease (fewer buys), and the holding costs (storage, theft, obsolescence, cost of money, and disposal costs) increase. The sum of these three sets of costs produces a total cost curve. The EOQ is the quantity at the minimum cost on the total cost curve. Therefore, inventory systems will recommend that users buy this quantity.

For a quantity discounted item, Figure 5 illustrates a set of total cost curves obtained for each range.

As shown in Figure 5, the EOQs of the latter ranges can occur in the earlier ranges, even the first range. The lower unit prices are valid only for purchase quantities within quantity discount Ranges 2 and 3. Thus the EOQs of Ranges 2 and 3 have to be adjusted to the first quantity of their respective ranges.

This is the essence of the quantity discount analysis. As illustrated in Figure 5, an EOQ Analysis Tool that does not handle quantity discounts will always recommend purchase quantity in the first range, regardless of which unit price

FIGURE 3. **Total Cost vs. Quantity (Revised)**

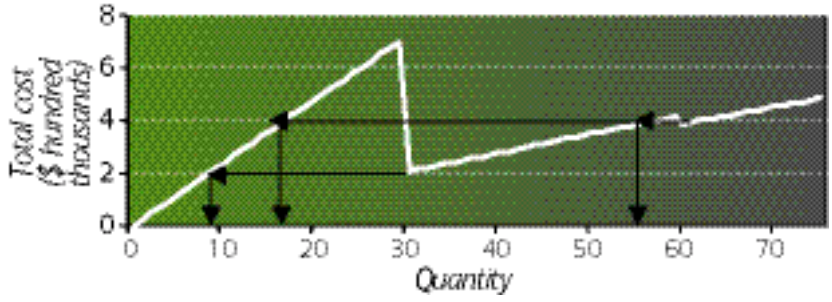
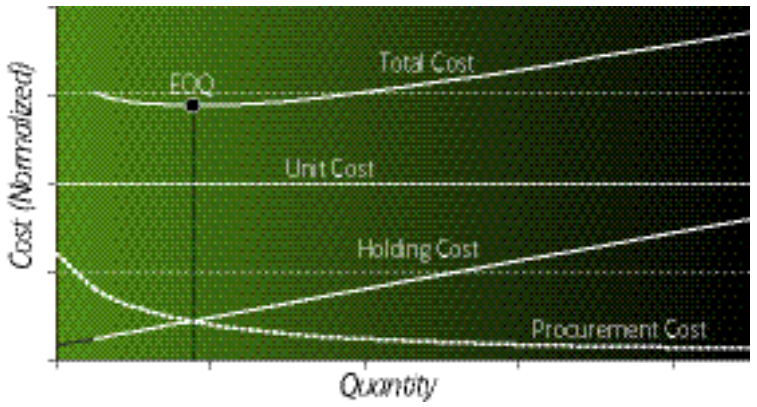


FIGURE 4. **Economic Order Quantity (EOQ)**

- **Objective**: Find the quantity to buy with Minimum Total Cost EOQ
- Total Cost = Purchase Cost + Procurement Cost + Holding Cost



is used in determining the EOQ. So if the purchasing/inventory system does not have the ability to consider more than one range/unit price and make the necessary EOQ adjustments, then it could be selecting the wrong quantity to buy, and the lowest total cost to the buyer is not achieved.

As previously mentioned, we have developed a user-friendly, stand-alone two-page spreadsheet program (input page and output page) using Visual Basic in Microsoft EXCEL 2000. The user enters the data and the spreadsheet determines the best EOQ. Space does not permit a full explanation of the spreadsheet's capabilities; however, users will find that our spreadsheet program can handle one-time buys, recurring buys, and one-time buys within recurring buys. The user can test other quantities and their costs versus the recommended quantity. Another nice feature is the ability to provide more than one buying alternative when less than two buying periods remain. A full explanation and examples accompany the spreadsheet.

Three Other Ways to Save

While doing this work we often receive excellent suggestions. The first suggestion in particular is quite effective in saving money.

Purchase Spare Parts and Systems with the Same Parts Simultaneously

Quantity discounts apply to systems as well as spare parts (initial, pipeline, and replenishment). Anthony Croce, an engineer at Project Manager, Warfighter Information Network—Tactical (PM WIN-T), suggests that the spare parts and systems that contain the same parts be purchased simultaneously from the contractor. By considering the individual system parts with the same spare parts, we can purchase the spare parts at a lower unit cost and hence lower total cost.

Simultaneous Purchase May Lower Cost of System Parts

We would argue that similarly, the purchase of the spare parts may cause the system parts to be purchased at a lower unit cost and this too would lower total cost.

Up the Quantity

Finally, the sum of the spare parts and system parts may be close to the end of the range, and it may make economic sense to buy the first quantity of the next range. In this case we receive more parts at a lower total cost.

These three savings need to be realized at all opportunities by DoD, other government agencies, and industry.

A Better Way

Government and industry computerized inventory systems do not correctly calculate the buy-quantities for quantity-discounted items. This analysis and the spreadsheet tool correct the deficiencies and in turn save money and provide more goods to any buyer for any commodity. We estimate that DoD can save $500 million per year using this analysis and spreadsheet.

Contact Us and Start Saving Now

In this article, we have tried to show that although quantity discounts may require us to use more decision-making information, we can save money and receive more goods. Additionally, the Quantity Discount EOQ Analysis Tool, obtainable at no cost from the U.S. Army Communications-Electronics Command, will provide computational recommendations with this added information.

To obtain the spreadsheet tool and associated document files, contact any of the three authors:

- **Michael.Bogner@c3smail.monmouth.army.mil**
- **Bernard.Price@mail1.monmouth.army.mil**
- **Chuck.Wong@mail1.monmouth.army.mil**

Also, briefings can be provided. *Have fund cite, will travel.*

FIGURE 5. **EOQ With Range Quantity Discount**